Soil Conservation

April 1978

U.S. Department of Agriculture

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From the Administrator

Conservation in a Hurry

When flood, forest fire, hurricane, or other havoc strikes, many public and private organizations move quickly to set up shelters, rescue survivors, and locate victims. They help people begin cleaning up, filling out insurance forms, and getting their lives and businesses back on course. These are the familiar stories of disasters and disaster relief we see on television and read about in newspapers.

Many natural disasters do another, less publicized, kind of damage. They destroy much of a watershed's natural protection against excessive runoff and erosion, leaving the stricken area more vulnerable than ever to landslides, floods, and contaminated water supplies. Cleanup and rebuilding efforts may themselves be threatened.

Reducing hazards created by sudden disasters is the role of the Soil Conservation Service under Section 216 of the Flood Control Act of 1950. Since 1960, more than $120 million has been used for watershed repair work after disasters, including forest fires; Hurricanes Camille, Agnes, and Eloise; failure of the Teton Dam; and the most recent Johnstown flood.

On request, SCS provides emergency assistance to slow down runoff, reduce soil erosion and sedimentation, prevent failure of weakened structures and contamination of water, and restore waterway capacity.

To protect damaged watersheds from further harm, SCS relies on simple but proven measures:

- Seeding, fertilizing, mulching, and fencing to establish a quick cover of vegetation on eroding areas;
- Installing debris basins and sediment traps;
- Reshaping, revegetating, and riprapping to stabilize streambanks and channels that have been left raw and crumbling;
- Opening stream channels that have been blocked by debris and sediment;
- Maintaining fire lanes and important roadways in forested areas.

These actions, familiar to professional soil conservationists, are the same conservation practices that protect soil and water resources on many farms and ranches and in urban areas. When disaster wipes out Nature's own defenses against runoff, erosion, and sedimentation, these conservation practices become an urgent necessity to safeguard lives and property.

Mel Davis

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Cover:
SCS provided flood-stricken Johnstown, Pa., with emergency assistance. See article on pages 4 and 5. (Photos, Johnstown *Tribune-Democrat*.)

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Johnstown: Underwater Again

Last summer, Johnstown, Pa., was hit by its third devastating flood in less than 100 years. SCS provided emergency assistance in the flood-stricken area.

by Graham T. Munkittrick

The water supply reservoir at Tanneryville, just north of Johnstown, broke and sent a 12-foot-high wall of water through the valley crushing houses into kindling. —courtesy, Johnstown *Tribune-Democrat.*

SCS Civil Engineer Jon Lantman (left) from the Somerset Area Office works on construction specifications with John Robb, river basin leader, and Walter Bolles (right), civil engineer, from the SCS State office in Harrisburg.

It was a night of terror for Johnstown. The rain started falling late on July 19, 1977. In the next few hours, 13 inches fell, turning streams into torrents in an eight-county area of Pennsylvania.

At Tanneryville, just north of Johnstown, the water supply reservoir broke at 4 a.m. on July 20, sending 100 million gallons of water cascading into the already flooded valley. A 12-foot-high wall of water, moving at an estimated 60 miles an hour, crushed houses into kindling.

Floodwaters devastated sections of rural areas, villages, and cities. More than 75 persons were reported dead or missing.

A steel beam from a demolished building was found bent like a horseshoe. According to steel company engineers, it would have taken a force of more than 30,000 pounds per square inch to bend the beam.

Along Solomon Run, which passes through several boroughs and the city of Johnstown, floodwaters spilled over a 20-foot-wide concrete-lined channel and cut a path through the city four blocks wide. The water ripped out streets and sidewalks; water, sewer, and gas lines; homes and businesses; and a four-story apartment building.

The flood filled many stream channels with debris and scoured streambanks. It even relocated some streams.

In Laurel Run, much of the streambed was gone. About 2 miles of the valley floor lost an average of 4 feet of soil.

On August 11, the Federal Disaster Assistance Administration (FDAA)

gave the Soil Conservation Service (SCS) the assignment to restore streams in the Johnstown area to their preflood condition.

In emergency situations, under Section 216 of Public Law 81–516, SCS has authority to stabilize streambanks and clear debris from channels to safeguard lives and property from further flooding and erosion.

Because Section 216 funds in the amount needed were not readily available, FDAA advanced SCS the money to start Section 216 work right away.

The SCS State office in Harrisburg, Pa., coordinated the effort, and the SCS Somerset area office was used as the operations center. Area Conservationist James Gettinger was put in charge of the emergency assistance work.

An engineering and contracting section was set up at the operations center for the 13 SCS engineering teams that were sent into the eight-county area.

In Johnstown, SCS people moved into the office of the Federal Coordinating Officer—who is appointed by the President—to help him coordinate emergency assistance work with the other disaster agencies. SCS people also helped keep communication open with lawmakers, officials of municipalities and other units of government, and the public.

In the first week after taking the Johnstown assignment, SCS awarded 13 contracts for removing debris from stream channels and stabilizing streambanks by riprapping, seeding, or regrading.

In the first month, more than $6 million of stream restoration work was planned, contracted, or completed.

The flood also had relocated a channel of the South Fork of the Conemaugh River onto a section of railroad tracks that run between the towns of South Fork and Lloydell. The original channel was choked with rock and rubble and needed to be cleared to restore the water flow capacity.

On August 18, SCS was assigned immediate restoration of the South Fork channel.

The next day, an SCS engineering team determined the amount of debris that had to be removed and wrote specifications for the size and type of equipment that would be needed. The team also determined the methods of stream restoration that would cause the least damage to the environment.

By late that night, bid invitations were completed, legal notices delivered, and a 5-day bid period began. Construction on the South Fork was completed in 45 days.

In the Johnstown area, SCS assisted with a total of 275,000 tons of riprapping, 395 acres of seeding, and 62 miles of clearing streams of debris.

The Johnstown flood of 1977 was a cruel disaster. Nothing could change that. But SCS helped protect the area from further sedimentation and erosion along damaged streams.

Mr. Munkittrick is State conservationist, SCS, Harrisburg, Pa.

SCS emergency assistance work in the Johnstown area included removing debris from Little Paint Creek.

A water quality study on four farms in Colorado gives best management practices for controlling pollution from salt, nitrates, and sediment.

Improved Irrigation: Key to Water Quality in Colorado

As part of the water quality study, a weir is used to measure water flow (below) and a soil moisture extraction tube is used to test salt buildup in the soil profile (right).

A sediment pond on one of the four farms studied is used to measure erosion from irrigated cornfield.

Preliminary results from water quality studies on four irrigated farms in northern Colorado indicate alfalfa buffer strips, improved irrigation systems, and improved irrigation water management will be the most effective best management practices.

The studies were completed in summer 1977 by the Toups Corporation, a Colorado engineering firm. They were conducted as part of the Larimer-Weld Council of Governments' water quality study, under Section 208 of the Federal Water Pollution Control Act Amendments of 1972. Working under an Intergovernmental Personnel Act agreement with the Council of Governments, Kent Ververs, formerly Soil Conservation Service district conservationist at Greeley, assisted Toups with the studies.

The principal pollutants discharged by irrigated agriculture in the Larimer-Weld region are salt, nitrates, and sediment. Ververs assisted in conducting studies of these pollutants on four grain and livestock farms in Larimer and Weld Counties.

"Irrigated agriculture is the cornerstone of our economy. Over 500,000 acres are irrigated in the two counties and the value of crops is $175 million annually," said Ververs. Beef and lamb feeding operations add substantially to this figure. The two-county area leads the Nation in numbers of beef cattle and lambs fattened annually.

Water quality problems on the farms studied are typical of the problems faced by irrigators in the region. Studies were not made on dryland farms because of time limits

by Robert G. Halstead
and W. Tom Pitts

and the conclusion that the most significant water quality problems in the Larimer-Weld area stem from irrigated lands.

Two of the farms studied have high concentrations of salt in irrigation return flows. These are caused by irrigation water flowing over shallow shale deposits and dissolving salts. Salinity levels as high as 6,000 milligrams per liter (mg/l) were measured in subsurface drains on the two farms. Over half of the subsurface drain samples exceeded 1,500 mg/l of total dissolved solids; concentrations over 1,500 mg/l will reduce crop yields.

Irrigation return flows were found to increase salinity from approximately 50 mg/l as the major tributaries leave the mountains to as much as 1,500 mg/l at the confluence of the South Platte River. Salinity levels of the South Platte increase from approximately 700 to 1,200 mg/l as it flows through the Larimer-Weld region.

"As a result of the salinity study, the Toups Corporation found that salt pollution could be lessened by reducing excessive seepage and subsurface return flows across shallow lying shales," explained Ververs. "Lining canals and ditches with concrete, using shorter irrigation runs, and irrigating according to crop needs and soil leaching requirements are the best management practices Toups recommends to reduce salt concentrations."

High concentrations of nitrates were found in ground waters of another farm in the study. The farmer applied manure heavily to crops grown on sandy soils, and nitrates leached easily through the soil profile. Samples taken on the farm showed a nitrate content of 43 mg/l in irrigation well water. This converts to 100 pounds of nitrogen in the nitrate form for each acre-foot of water. If the farmer applies 2 acre-feet during the irrigation season, he would get enough nitrogen from the water alone to meet the requirements for corn.

"To reduce high nitrate concentrations, Toups recommends better manure and commercial fertilizer management and irrigation water management as best management practices," said Ververs.

"Most irrigators would benefit by reducing the length of their irrigation runs. This would allow more even distribution of water," he continued. "A long furrow run necessitates over-irrigation and leaching of the profile at the upper end of the field in order to get enough water to the lower end. A second line of gated pipe across the middle of the field would be an effective method for reducing length of runs."

Sedimentation was not a significant problem in most rivers of the region, according to Ververs. Most have flood plains which serve as buffers prohibiting direct discharges of irrigation tailwaters to the river. However, there was a noticeable increase in sediment in the Little Thompson River.

"We attribute this sedimentation to the steep slopes and fine soils in the area," said Ververs. "Also, there is considerable farming right to the river's edge.

"For the farms around this area, Toups recommends a series of alfalfa buffer strips as an effective management practice along the river," Ververs continued. "Tailwater collection ponds with a pump back system would also catch sediment and allow the farmer to reuse irrigation runoff."

Local input by farmers and other community leaders has strongly influenced the Larimer-Weld study. The Council of Governments has a cooperative agreement with 10 soil conservation districts, SCS, the State Soil Conservation Board, a three-member executive committee, and a 100-member citizen advisory committee.

Eric Eidsness, director of 208 water quality planning for the Larimer-Weld Council of Governments, said, "It's apparent we haven't solved all the problems related to agricultural pollution. Additional studies will be necessary, as well as accelerated cost share and technical assistance."

However, the 208 study for the Larimer-Weld region of Colorado shows that conservation practices can be adapted and applied to achieve improved water quality.

Mr. Halstead is State conservationist, SCS, Denver, Colo.
Mr. Pitts is vice president, Toups Corporation, Loveland, Colo.

No-till forage seeders are making pasture and hayland renovation quick and easy while leaving a protective cover on the land.

by Phillip Bousman

No-Till Forage Renovation

A new method of renovating pasture or hayland is being tried in Greene County, Ind. Usually, farmers in the area renovate by plowing and disking the seedbed or disking the sod two or three times before reseeding. This destroys most of the soil's protective cover.

In this area of southern Indiana, forage is grown mainly on silt loam soils with rolling topography. The soils erode easily if not protected.

Because of this potential erosion problem, Leon Vandeventer, who owns a dairy farm near Bloomfield, decided to renovate one of his hayfields with a no-till forage seeder. The seeder cuts shallow grooves in the sod, drops the seed into the grooves, and presses the seed tightly into the soil, leaving the sod virtually undisturbed.

Vandeventer, a cooperator with the Greene County Soil and Water Conservation District, is the first farmer in the area to try the new method.

"A well-balanced mixture of grass and legumes for hay is important," he said. "The legumes provide the nitrogen needed for an improved stand and give me a better quality forage."

In 1976, Vandeventer, working through the district, asked the Soil Conservation Service for assistance in planning his no-till seeding. He had seeded his hayfield 5 years before with orchardgrass and alfalfa, but nearly all the alfalfa had disappeared.

In early April 1976, using a soil test, Vandeventer determined that his soil needed lime and fertilizer. After adding the nutrients, he used the no-till seeder to seed 10 pounds of red clover per acre, in rows 10 inches apart.

Before the clover germinated, he sprayed a contact herbicide to reduce grass competition and to leave a mulch to protect the soil from erosion. The grass recuperated from the herbicide in about 5 weeks.

By early July, his forage of orchardgrass and red clover was ready to be cut.

"I've been very satisfied with no-till forage renovation," Vandeventer said. "I could sow the legume seed earlier in the spring, I saw no erosion from my hillsides, and my first hay crop was ready in only 3 months."

A no-till forage seeder cuts shallow grooves in sod, drops seed into the grooves, and presses the seed into the soil. The sod is left virtually undisturbed.

Mr. Bousman is district conservationist, SCS, Bloomfield, Ind.

by Nadine E. Pitts

New Design for No-Till Planter

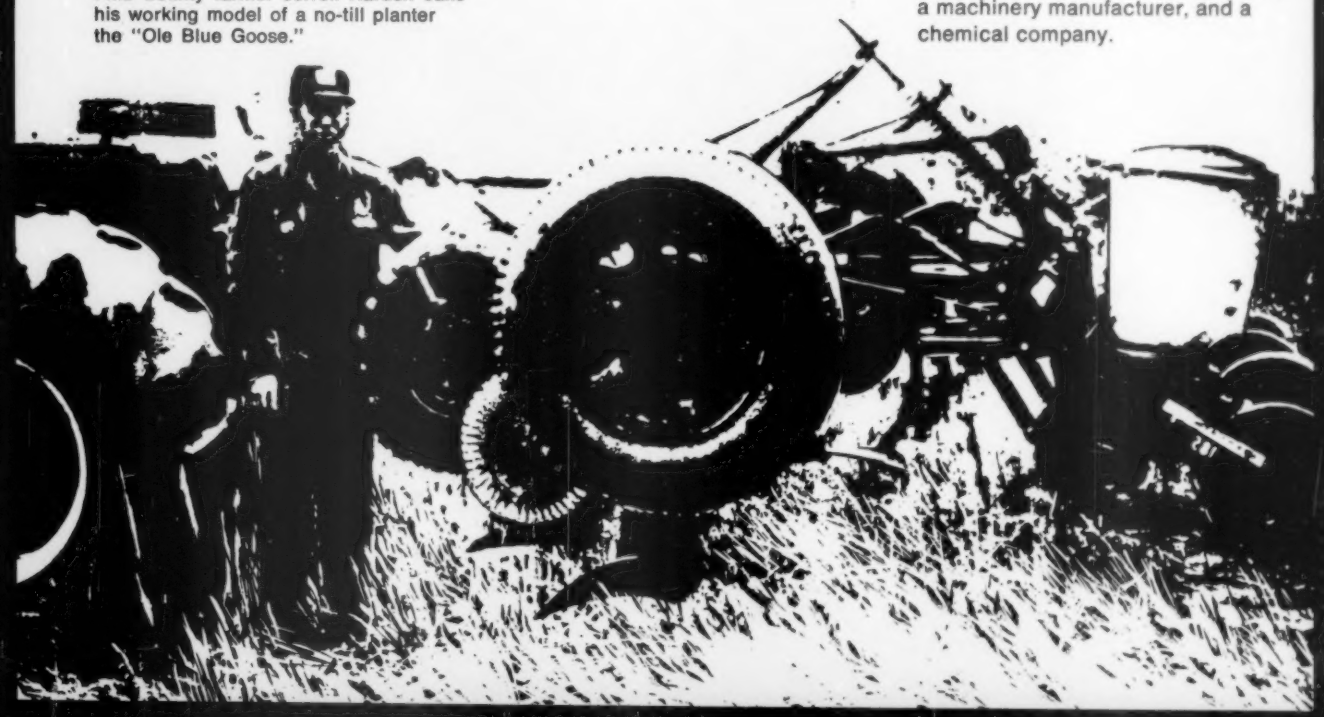
A no-till planter developed by two Alabama farmers is boosting soil conservation and crop yields in several southern Coastal Plain States.

Neighbors in the early 1970's fondly called it the Harden family's "Ole Blue Goose." All who saw it agreed it was the strangest-looking planter they had ever seen.

A working model, the "Ole Blue Goose" gradually was transformed into a modern no-till planter. It helped bring about some welcome changes in farming in the southern Coastal Plain—an increase in conservation tillage and an increase in research on conservation tillage.

Brothers Jerrell and Leo Harden of Banks, Ala., cooperators with the Pike County Soil and Water Conservation District (SWCD), learned about no-till farming firsthand in 1972, at a no-till demonstration conducted on their farm by the Soil Conservation Service's Alabama State Office, the Pike County SWCD, a machinery manufacturer, and a chemical company.

Pike County farmer Jerrell Harden calls his working model of a no-till planter the "Ole Blue Goose."



The next year, the Harden brothers and their father, J. C. Harden, planted no-till corn in a residue of rye using a conventional no-till planter. In one field, they subsoiled prior to planting and had excellent results. In another field, the plants were stunted and the yield was low; the soil had become so compacted that the corn roots had stopped growing at a depth of 6 to 14 inches. The roots of corn in good soil normally reach a depth of 6 feet in 3 months.

To find out more about their problem with compacted soil, the Hardens turned to the Pike County SWCD and SCS. Charles Pollard, then SCS district conservationist in Troy, and Lewis Williams, SCS State conservation agronomist, directed them to the National Tillage Machinery Laboratory in Auburn, Ala.

A. C. Trouse, Jr., laboratory soil scientist, identified the Harden's problem in their low-yield cornfield as "plowpan," soil compacted by farm machinery. It is a common problem on the sandy soils in the southern Coastal Plain.

It was after their meeting with Trouse that the Hardens decided to redesign their planter to combine subsoiling and no-till planting into one operation. Jerrell Harden, described by Trouse as a "mechanical genius," made sketches of the design changes, then constructed test models of redesigned implements for the planter. His objective was a planter that would work well even in compacted soil and would cut down drastically on machinery traffic.

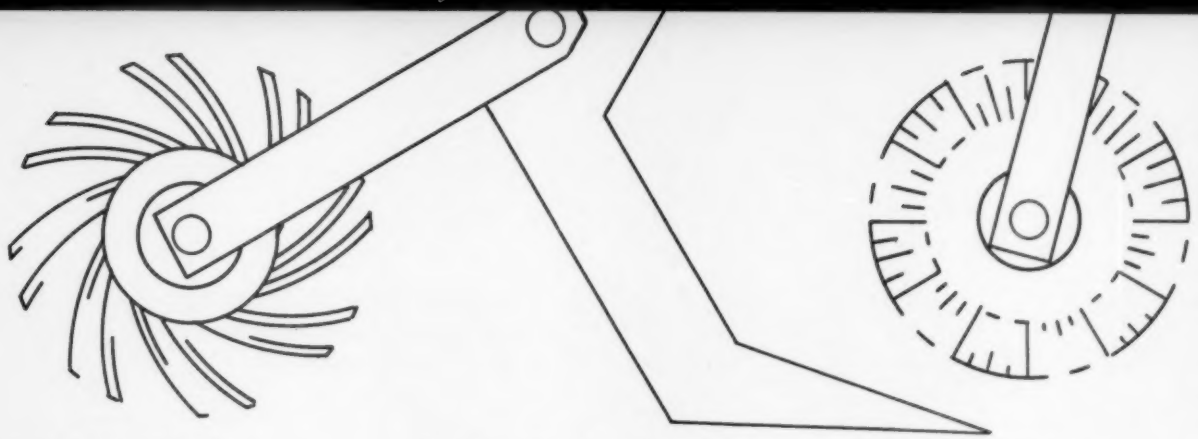
In 1974, the Hardens were ready to try out the renovated planter. They seeded 200 acres of corn in a cover of killed rye. That year, their yield averaged 100 bushels an acre. In 1975, they had the same yield—compared with the Pike County average of 40 bushels an acre.

What was unusual about their planting method was that by combining no-till planting with subsoiling, they restricted traffic during planting to a single trip across the field. The Hardens called the one-trip, no-till planting "no-till-plus," and both the name and the method caught on quickly.

Trouse did not think no-till-plus would work in the Hardens' compacted fields. "I advised against it," he said but readily admitted he was glad it had worked.

Jerrell and Leo Harden patented their inventions and incorporated them in a new no-till planter called a "superseeder." It is being manufactured by a company partly owned by the family in nearby Ozark, and by mid-1977 the company was

The Hardens incorporated their inventions in a no-till planter they call a "superseeder."



doing a thriving business.

A spike-toothed, slot-filler wheel is unique to the Hardens' planter. In tandem, the wheel follows the spring-loaded coulter and subsoiler shank to fill the slot cut by the subsoiler, thus preventing seeds from dropping down too far into the soil. Equipment for incorporating herbicides and fertilizers in the slot or on the surface and a conventional planting unit follow the wheel.

"Even with a 3-inch rain, there's no run-off on no-tilled, in-row subsoiled land because the subsoiled slot is like a funnel," said Jerrell Harden.

In March 1977, a sandstorm in Pike County killed some conventionally tilled crops and seriously eroded the land, but there was little sand or wind damage to the Hardens' no-till-plus corn, according to Pollard.

Kenneth Sanders, a cooperator with the Coffee County SWCD, used the planter in 1977, and obtained 80 bushels of corn an acre—a high yield for that area during severe drought conditions. He said that his neighbors' conventionally tilled corn crops were so poor that they did not bother to harvest them.

No-till-plus also has worked well on soybeans. The Hardens' soybean yield in 1974 averaged 44 bushels an acre, compared with the statewide average of 24 bushels an acre.

No-till acreage increased statewide from 12,000 acres in 1972 to more than 100,000 acres in 1977, and the SCS State office in Auburn reports a big increase in requests for information about no-till farming.

"Saving water alone may turn farmers to no-till," said Leo Harden. "If you lose water in a field, you are losing soil and money."

"You can't beat a method like no-till-plus. It saves the soil and water and gives the farmer a greater reward for his efforts in higher yields and big savings in energy and labor costs," J. C. Harden noted.

The Hardens' planter and conservation tillage method are being evaluated by the U.S. Department of Agriculture's Science and Education Administration and the Alabama Agricultural Experiment Station. It is the first major research on no-till conducted in all areas of the State.

"If the planter and the method are as effective in saving soil, water, energy, and labor over a long period as they were in the first trials, they could revolutionize cultural practices in the southern Coastal Plain," said SCS State Agronomist Williams.

Ms. Pitts is a writer-editor, Information Division, SCS, Washington, D.C.

At left, J. C. Harden, showing no-till planter invented by two of his sons, is an eloquent advocate of no-till cropping. At right, Jerrell Harden (left) and SCS District Conservationist Charles Pollard examine good growth of no-till soybeans which were planted in rye stubble by in-row subsoiling.

by Nadine E. Pitts

Solving Tough Tillage Problems

The USDA's 44-year-old National Tillage Machinery Laboratory has made numerous contributions to improve farm machinery and tillage practices.

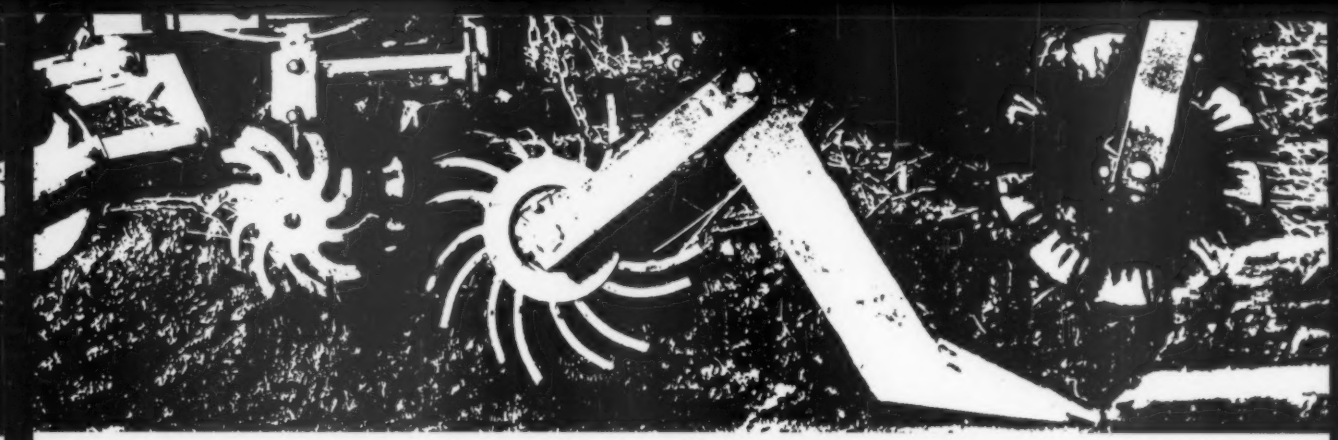
Too wet and sticky to plow? That age-old complaint has led some farmers to leave some of their land in sod for years.

Now the complaint may decrease, thanks to the work of scientists at the National Tillage Machinery Laboratory (NTML) of USDA's Science and Education Administration (SEA). The laboratory was formerly under the Agricultural Research Service, which is now a part of SEA.

Researchers at the laboratory have been studying the effects of farm machinery on soils for more than four decades on a 6.3-acre site within the campus complex of Auburn University, Ala.

NTML was created in 1935 to undertake research related to tillage practices and machine use in cotton production. The scope of the

Nine, 150-foot-long outdoor bins containing various soils are equipped with side rails which allow researchers to test a single element of a piece of machinery at varying forces.



laboratory's research has since broadened to include all types of tillage machinery and practices.

The lab's staff of 35, headed by W. R. Gill, soil scientist, includes seven agricultural engineers and two soil scientists. The staff has some unusual research facilities, such as nine outdoor bins containing soils on which tillage machinery can be tested at varying speeds. The staff also uses indoor soil bins and a controlled environment chamber to evaluate root growth under differing climatic conditions.

The bulk of the lab's research is carried out in its own facilities, although NTML has access to larger tracts for field studies. Its clientele includes farm machinery manufacturers and other researchers who seek the lab's advice and assistance on model changes and improvements affecting many farmers and large land areas. The staff occasionally works with individual farmers like the Hardens in Alabama. (See article beginning on p. 9.)

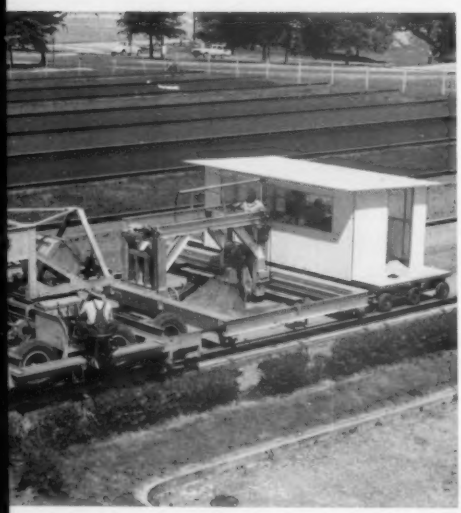
Known worldwide as an authority in its field, NTML has made numerous noteworthy contributions to soil conservation and modern farming. One answer to the problem of wet and sticky soil is the laboratory's most recent invention, the lubricated moldboard plow.

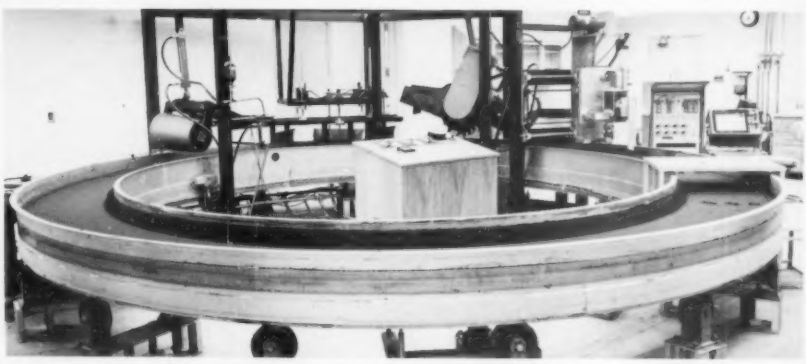
Over the years, NTML personnel, in cooperation with private industry, developed improved models of plows which operate well in highly adhesive soils such as Houston clay.

One early model, in which the moldboard of the plow was covered with a heavy plastic material, is still in use in southwest Georgia. Though the plastic is not extremely durable, it successfully buries peanut trash deep enough to control disease and decreases the plowing force by as much as 25 percent.

A recent plow model developed by Robert L. Schafer, an agricultural engineer with NTML, and others in cooperation with private industry is lubricated with a biodegradable, 2- to 3-percent polymer-water solution. All a farmer may need to convert a conventional moldboard plow into a lubricated plow is an inexpensive distribution system and the lubricant. Other components are similar to those used for spraying and other farm operations.

"There are lots of advantages to the lubricated plow," said Schafer. "It reduces the amount of energy required to pull it, it improves scouring and self-cleaning, and it turns the soil more efficiently."

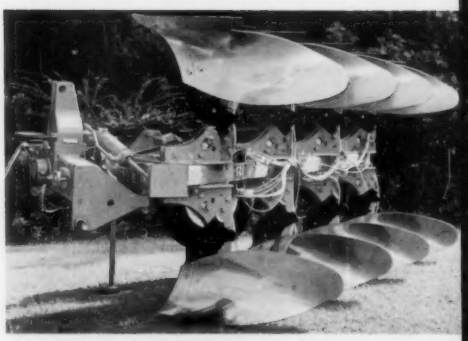




Left, as machinery attached to a power car rides the rails for testing, an instrument car simultaneously collects data and transmits it to computers for analysis.

Above, a small, circular indoor bin is used to test models of farm equipment on synthetic soils.

NTML engineers modified a reversible plow (near right) so tubing carries lubricant through a slitted keystock (far right) to the plow blade.



The laboratory also conducts studies on cropland damage caused by uncontrolled machinery traffic.

Above left, the root growth of conventionally planted corn is cut off by compacted soil layer called plowpan. Above right, subsoiling in a cover crop of rye breaks the plowpan and allows roots of next crop to grow normally.

Research was conducted at the laboratory on cotton grown using conventional tillage (far left) and using subsoiling and controlled traffic.

One answer to the problem of wet and sticky soil is the lab's most recent invention, the lubricated moldboard plow.

The same lubricating principles can be applied to bulldozers and other equipment, and NTML is testing a lubricated lister.

"The lubricated lister will help to prepare sticky soil in the fall and allow early planting of some wetlands formerly restricted to sod," said Gill.

The researchers have also studied the effect of tractor and other farm equipment tires on soil. Innumerable tests were made with tire lugs and treads of varying shapes and sizes prior to NTML's recommendations for improvements.

"Tires began to change in size and shape as demands for equipment able to carry heavier loads and travel at faster speeds increased," Gill remarked. "NTML's problem was to determine what designs were best suited for meeting farmers' needs."

The NTML also conducts studies on cropland damage caused by uncontrolled machinery traffic. The lab began with extensive research on cotton cropland and later expanded the research to include crops such as corn, peanuts, and soybeans.

Soil Scientist A. C. Trouse, Jr., is the principal researcher of the traffic studies. He found that soil compacted by machinery could be avoided when traffic is controlled or confined to the same lanes each year.

Farmers often find it difficult, however, to locate tire tracks from one year to the next. A study underway at the Alabama Agricultural Experiment Station (AES), with the cooperation of NTML, is designed to solve the problem.

"Tractors are being steered by an automatic guidance system," said Schafer, "and programmed to locate and run in the same 'roadbed' time after time."

The NTML staff frequently consults and cooperates with other SEA scientists and agricultural experiment stations in all the States. The staff assisted the Alabama AES, for example, in its evaluation of subsoilers, including the one on the Harden family's no-till planter.

When research results reach farmers and help them improve their land and crops, NTML scientists feel rewarded.

"Some farmers have begun to heed our findings about the importance of controlled traffic," said Director Gill, "and both their soils and their crop yields are improving."

Ms. Pitts is a writer-editor, Information Division, SCS, Washington, D.C.

Charter of the National Tillage Machinery Laboratory

The National Tillage Machinery Laboratory conducts research in soil-machine-plant relations. The objective of the laboratory is to increase the efficiency and effectiveness of tillage and traction machinery by developing a better understanding of soil-machine-plant relations. Anticipated benefits are improved crop production and conservation of energy, soil, and water resources.

The research program includes investigations of:

- **The identification and characterization of soil and machine parameters and the determination of their integrated role in governing soil-machine relations.**
- **The performance of model and full-scale, ground-engaging components of machines in terms of design and energy indexes and soil-machine relations.**
- **The influence of tillage, traction, and transport machines on soil physical conditions, runoff, and erosion.**
- **The relation of soil physical conditions and mechanical properties to wear, durability, and performance of machines, and to the growth of plants.**
- **The materials and processes suitable for improving the design, construction, and use of ground-engaging components of machines.**
- **The soil conditions required by plant roots, and methods of creating and maintaining these conditions in conservation tillage systems.**

More than a decade ago, two North Carolina farmers began experimenting with minimum tillage. Today, they consider their experiments successful in saving soil and energy.

by Wilton U. Smith

Minimum Tillage Pioneers

In 1962, when the Wilder brothers of Franklin County, N.C., first heard about minimum tillage, they were cautious. So they borrowed a fluted coulter, attached it to their planter, and planted their first minimum-tilled field of milo.

In 1966, impressed by the fuel and labor savings and soil and water conservation, Larry and Melvin Lee Wilder bought their own fluted coulter and planted 1,000 acres of corn and another 1,000 of soybeans, using minimum tillage.

"Because we started experimenting with minimum tillage back in 1962, I guess you could call us minimum tillage pioneers," said Larry Wilder. "We've never been sorry we tried it."

The Wilder brothers have been cooperators with the Franklin Soil and Water Conservation District since 1961. With assistance from the district and the Soil Conservation Service, they developed a conservation plan in 1963 that included terracing and stripcropping. But in 1971, they revised their plan to include minimum tillage because of their successful experiments with it.

In 1977, they planted 900 acres of corn—virtually all minimum tillage—and 450 acres of barley. Another 450 acres were planted in minimum-tilled soybeans and 450 acres in conventionally tilled soybeans.

The Wilders rotate soybeans and corn, mainly for weed, insect, and disease control. They plant their minimum-tilled soybeans in barley residue as soon as the grain is cut.

"You have to use residue for minimum tillage," said Larry Wilder, "because it's too expensive to establish sod."

In some recent years, they have also grown wheat. But, as Larry Wilder explained, "We prefer to grow barley because we like those high yields."

The brothers' corn yields have been as high as 130 bushels an acre, but they average 85 to 90 an acre, still above the county average.

"Our farmland averages 5 inches of topsoil and with minimum tillage we make sure we don't lose any," explained Larry Wilder. "Minimum tillage is the way we can stay in farming."

Mr. Smith is district conservationist, SCS, Louisburg, N.C.

Farmer Larry Wilder examines his six-row minimum tillage planter

No Drought in Paradise

A gravity pressure sprinkler irrigation system provides a community in Utah with a dependable water supply. Farmers have enough water even at critical irrigation periods.

by Beverly J. Miller

One of the results of the gravity pressure irrigation system in Paradise is increased crop production.

Last year's drought had little effect on the residents of Paradise. Instead, they were reaping the benefits of a gravity pressure sprinkler irrigation system that had been installed 5 years before.

But residents of this small northern Utah community weren't always so fortunate.

"In the olden days, earthen ditches and canals were used to flood irrigate cropland and some yards and gardens," said Burnard White, mayor of Paradise. "These open ditches and canals were dangerous to our children, were difficult to maintain, and didn't deliver a dependable water supply.

"Also, people were using the good-quality drinking water instead of irrigation water to keep their lawns green. Before the new irrigation system, nearly two-thirds of the homes ran out of irrigation water for lawns," he continued. "Now we've all agreed not to use the drinking water for irrigation."

The sprinkler system eliminated the ditches and canals. Now, underground pipelines deliver irrigation water about every half-block in town and to the surrounding farmland as well—a total of about 480 acres.

The system was designed to improve the efficiency of irrigation water delivery, but only the system's users could improve the efficiency of water application.

To help area farmers, Soil Conservation Service technicians showed them how to use a soil auger to sample soil and check the soil's water content. The farmers learned how to determine whether their soil needed water and, if so, how much.

With the irrigation system, area farmers can depend upon having enough water for their crops, even at the most critical irrigation periods.

"Residents agreed to a watering schedule of 12 hours every 7 days on crops and anytime for yards and gardens," explained Mayor White. "And now, because they know when and how much to water, they're using only half the amount they used before the system was installed."

Overall irrigation efficiency has increased from 25 to over 65 percent during the past 5 years. Crop production has increased and the community has benefited economically.

"If it weren't for this new irrigation system," said White, "my water bill would have been more than $250 this year. As it is, I'm only paying about $60."

Partly because water is readily available now, property values have increased from about $1,000 for a 1¼-acre lot to over $6,500.

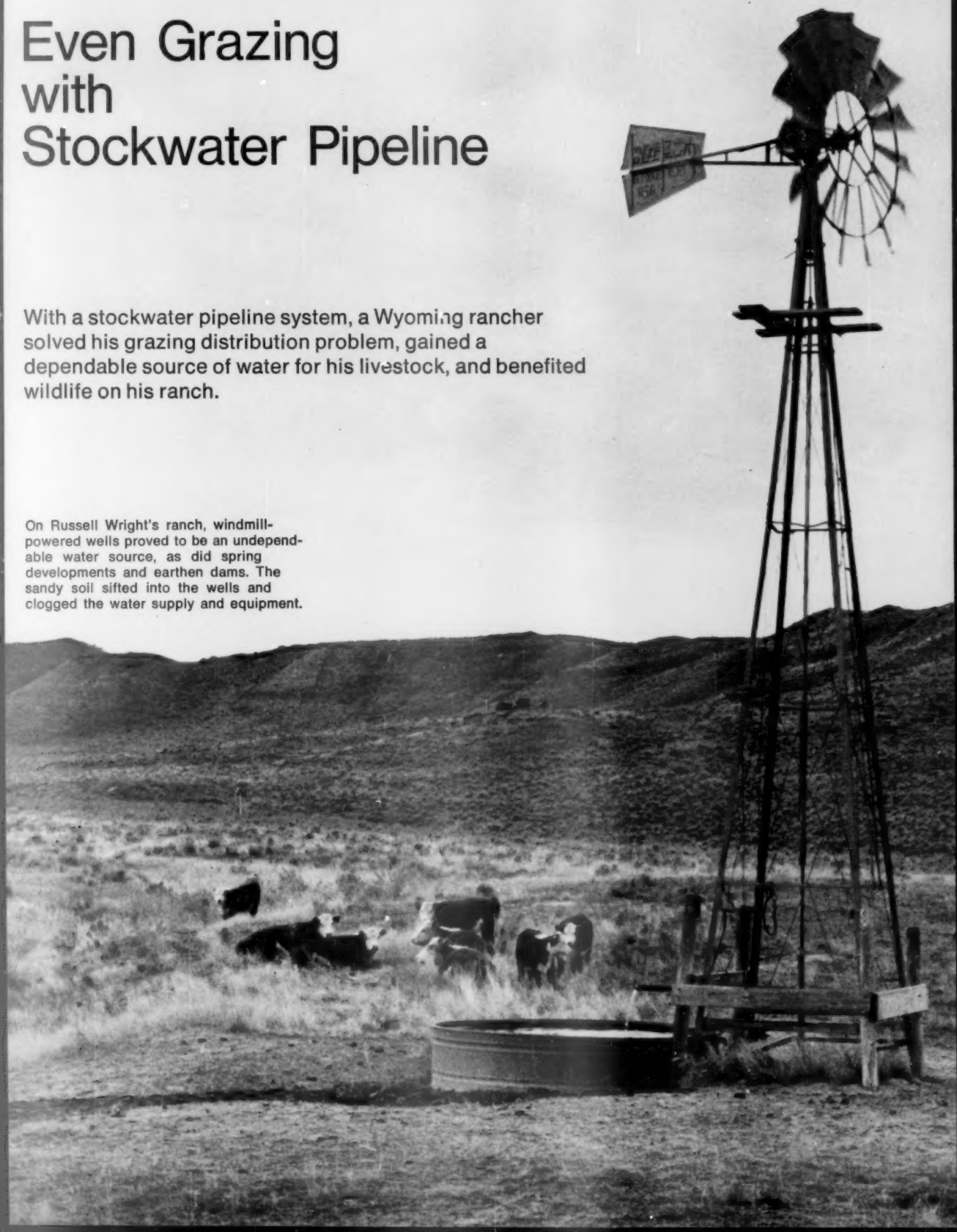
The gravity pressure system is an energy saver because pumps are not needed. An added benefit, according to Mayor White, is improved fire protection—"in the summer, it's the best in Utah."

The Paradise irrigation system was installed through efforts of the Paradise Irrigation and Reservoir Company, Paradise City, and Blacksmith Fork Soil Conservation District. SCS provided technical and financial assistance through the Bear River Resource Conservation and Development (RC&D) area. The construction cost for the project was about $106,500. Local funds paid $66,000 of the cost and the rest was paid with RC&D cost-share funds.

Ms. Miller is public information officer, SCS, Salt Lake City, Utah.

Even Grazing with Stockwater Pipeline

With a stockwater pipeline system, a Wyoming rancher solved his grazing distribution problem, gained a dependable source of water for his livestock, and benefited wildlife on his ranch.



On Russell Wright's ranch, windmill-powered wells proved to be an undependable water source, as did spring developments and earthen dams. The sandy soil sifted into the wells and clogged the water supply and equipment.

by Anne Schuhart

Russell Wright (left) and SCS District Conservationist Frank Neal check the shallow well that draws water from Clear Creek to supply the stockwatering system.

Russell Wright had a problem common to many ranchers in eastern Wyoming: he couldn't find a dependable way to water his cattle in different parts of the range to distribute grazing evenly. Now he's found the solution in a sophisticated stockwater pipeline system.

"We went to the pipeline because we've spent well over $30,000 in these hills building earthen dams, developing springs, and drilling wells, and none have been satisfactory. We think this pipeline finally is going to work," said Wright. He has operated the 9,100-acre ranch near Buffalo, Wyo., along with his sons since 1957.

The pipeline system begins with a shallow well beside Clear Creek, near the ranch headquarters. A 2-horsepower pump draws water from the creek and forces it through 23,000 feet of 2-inch plastic pipe into two 12,000-gallon storage tanks at the highest elevation on the ranch, 4,700 feet. The pipeline and storage tanks are buried 5 feet deep to avoid the frost, and an ordinary light bulb in the well keeps the pump from freezing.

Float valves in the storage tanks shut off the pump when the tanks are full by tripping a pressure switch at the well. From there, the system works by gravity.

"When the Soil Conservation Service designed the system, I thought it would take a 3-horsepower pump to do the job, but the pump company guaranteed the 2-horsepower, which saves some energy," said Wright.

The completed system will include four watering tanks along the main line and 15 additional watering tanks along nine spur lines, which will radiate out from the storage tanks.

A float valve in each tank, similar to the float valve in a toilet tank, maintains the water level. When the tank is full, a frost-free hydrant drains excess water back underground instead of letting it stay in the above-ground part of the pipe where it could freeze. Wright also floats a wooden plank in each tank "to keep the birds from drowning."

A cooperator with the Lake DeSmet Conservation District, Wright requested that SCS design the pipeline system to meet the requirements of 600 head of cattle on 8,800 acres of range. He installed the well, main line, storage tanks, and first two spurs last summer under his Great Plains Conservation Program contract.

"Already we're seeing better use of our pasture," Wright said. "In one area the grass was mostly wasted because the cattle had to travel more than a mile to get to water. In another part of the ranch, the cattle had to climb a high hill to get to water—that made almost a whole section useless. But since we installed the new tanks, both areas are pretty well grazed."

In addition, the completed system will give Wright the option of starting a planned grazing system. Without the pipeline, he was forced to let the cattle graze wherever water was available.

"My stockwater pipeline also benefits my flock of 127 sheep and the wildlife on my ranch. We have 300 head of deer or better," Wright said. "At one time, we had a couple hundred head of antelope, but there are only about 50 today. We also have Wyoming sage hens, prairie chickens, pheasants, Hungarian partridge, quail, ducks, and some Canadian geese. Of course, the bobcats are plentiful, and so are coyotes, badgers, and skunks. Directly or indirectly, all the animals benefit from a better water supply."

Ms. Schuhart is a writer-editor, Information Division, SCS, Washington, D.C.

Double Duty Dams

by Robert L. Harryman

Gullies were eating into county roads and damaging adjacent farmland (far left). Roadway embankment dams help stabilize gullies, improve roads, and provide water for livestock and wildlife (near left).

People in Mercer County, Mo., wanted to stop gullies, reduce sedimentation, improve township roads, and reduce road maintenance costs all at the same time. Roadway embankment dams proved to be the answer.

Storm runoff formed gullies 10 to 25 feet deep that were eating into county roads and damaging adjacent farmland in Mercer County and in the eight other counties making up the Green Hills Resource Conservation and Development (RC&D) Area. Runoff was digging out the soil from around and under road bridges until they were no longer anchored in the ground. Bridges and large culverts or pipes were constantly washing out. Water rushed through uncontrolled, adding to erosion problems further downstream.

The Green Hills RC&D Council helped the counties build roadway embankment dams to stabilize gullies and even provide water for livestock and wildlife.

The RC&D measures involved building a dam to replace small bridges or large culverts, forming reservoirs on the upstream side of the dam. Pipes 24 inches or less in diameter let the water through slowly into the channel below the dam. The pipes are designed to flow full of water and are made of smooth, high-quality steel.

Planning and building a road dam takes the cooperation of landowners, the township board, the county board, the county courts, utility companies, and the local soil and water conservation district. Easements must be obtained where construction will affect private property, and often, utility lines must be moved.

Generally, the best sites for roadway embankment dams in the Green Hills RC&D area drain 300 acres or less and are in depressions between two hills.

Based on storm frequency data, the dams draining small areas are built high enough and with an adequately designed spillway to safely handle unusually heavy rainfalls. Emergency spillways are built into dams that drain large areas.

In the last 2 years, the RC&D council assisted with construction of 12 roadway embankment dams in the 9-county area. Construction on 20 more structures is planned for 1978.

"We hope that in a few years it will be a common practice to build roadway embankment dams where they will solve a gully problem," said Marion Houghton, former chairman of the RC&D council. The roadway embankment dam structures control erosion, improve roads, and provide water for livestock and wildlife.

The Soil Conservation Service provides technical assistance through the local soil and water conservation districts in designing the dams and provides financial assistance on the projects through the RC&D program. The townships and counties where roadway embankment dams are built also help fund construction and are responsible for the proper operation and maintenance of the structures.

Mr. Harryman is RC&D coordinator, SCS, Bethany, Mo.

by F. Dwain Phillips

Taking Stock of Roadside Erosion

Coal County employees pour and shape concrete liner to control roadside erosion.

Erosion along county roads in Oklahoma had been recognized as a source of pollution for several years. But not until June 1977 did anyone know how extensive the problem was.

Oklahoma conservation districts and the Soil Conservation Service worked together on roadside erosion inventories for each of Oklahoma's 77 counties. After completing the inventories in June, they determined that more than 2.5 million tons of soil are lost annually through erosion along county roads.

Conservation district employees and soil conservationists and technicians drove every mile of county roads to pinpoint areas of erosion. They marked the locations of eroded areas on county maps and indicated the extent of erosion.

The conservation districts published the inventories and distributed copies to county commissioners, county planning boards, and State and Federal agencies to help them in planning and applying roadside erosion control.

The county roadside erosion inventories are especially useful to the Oklahoma Department of Pollution Control which has responsibility in the State for meeting water quality goals under Section 208 of Public Law 92-500, the Federal Water Pollution Control Act Amendments of 1972. The inventories are a guide to reducing sediment, a nonpoint source of pollution.

Using the inventories, county commissioners have already begun treating roadside erosion problems in Oklahoma. They are working on shaping and vegetating roadsides, lining runoff channels with concrete, and building road dams.

SCS is providing technical assistance on the projects through the conservation districts. Cost-share assistance also is available through SCS.

The Oklahoma Conservation Commission is providing up to $1,000 of matching funds to county commissioners for roadside erosion control projects.

Mr. Phillips is public information officer, SCS, Stillwater, Okla.

USDA Finds Soil Erosion at Unacceptable Levels

Soil is being washed away on the Nation's cropland at an average rate of 9 tons per acre per year—nearly twice the rate considered "acceptable" by soil conservationists, according to M. Rupert Cutler, assistant secretary for conservation, research, and education of the U.S. Department of Agriculture.

The soil loss rate was included by the Soil Conservation Service in a new study of erosion and sedimentation, made as part of the agency's commitment to the 1975 National Water Assessment of the U.S. Water Resources Council.

The study examines soil erosion from water action in 18 water resource regions covering the continental United States. Average annual erosion ranges from a high of 23 tons of soil per acre in the Lower Mississippi region to a low of 1 ton per acre in the California region.

Severe annual soil losses also occur in: the Tennessee region—19 tons per acre; the South Atlantic Gulf region—18 tons per acre; the Middle Atlantic region—14 tons per acre; the Upper Mississippi region—10 tons per acre; and the Ohio region—9 tons per acre.

In 1975, when data for the study were collected, total U.S. soil losses on cropland totaled 2.8 billion tons.

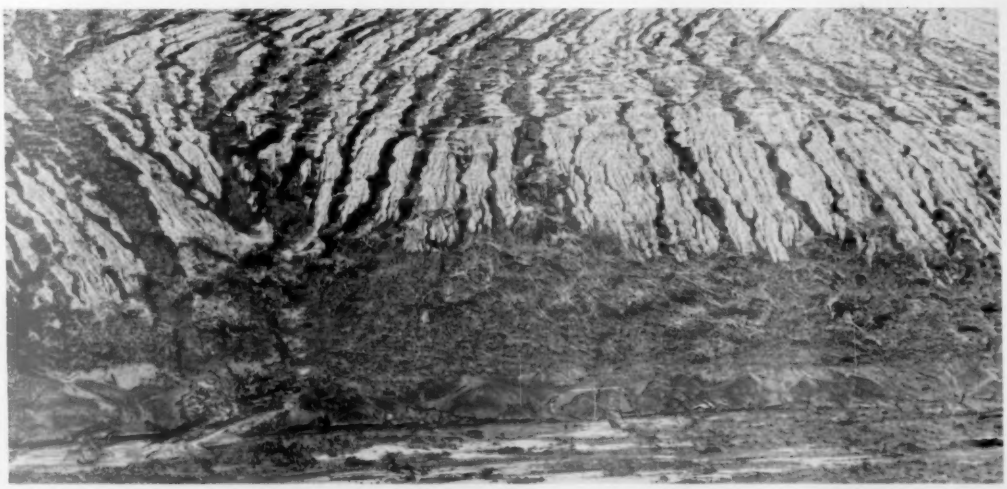
"Had there been no soil conservation treatment on the land," said Cutler, "soil losses that year would have reached an estimated 3.8 billion tons."

He added that conservation treatment needs to be applied to save an additional 1.3 billions tons of soil per year before acceptable levels of loss can be reached.

The SCS study also found that it is technically feasible for the United States to produce the food and fiber it will need to meet projected demand in the year 2000 and still achieve acceptable levels of erosion control.

"Soil losses could be reduced from the present average of 9 tons per acre per year to only 3 tons per acre per year without adversely affecting our ability to produce more farm commodities," Cutler explained. Actual losses, of course, would vary widely from farm to farm and region to region, because of soil types, slope, and other factors.

He added, however, that achieving this goal would require extensive expansion of land treatment from current levels. Nearly 42 percent of the 335 million acres of cropland harvested in 1975 were not receiving adequate treatment for soil erosion control, Cutler said.



A study examining soil erosion from water action reports average soil losses as high as 23 tons per acre per year.

Guide to Resource Planning

The Soil Conservation Service in Montana has a unique tool for resource planning. Its publication, "Climax Vegetation of Montana Based on Soils and Climate," includes the first climax vegetation map published for an area of the United States based strictly on soils and climate.

Climax vegetation refers to the natural plant communities expected to occur in a combination of soils and climate where the soils have not been excessively disturbed by external forces—man, animals, or fire.

The publication also includes a report which categorizes geographic areas of Montana on a broad scale. It gives the annual average precipitation in different areas of the State and describes groups of soils that have similar characteristics and the corresponding vegetation.

The authors, Robert L. Ross, State range conservationist, now retired, and Harold E. Hunter, State woodland conservationist for SCS in Montana, say they designed the map for use in broad resource planning.

"You can't look at the map and make specific recommendations because the delineations are too broad for that," Ross said. "But if you're looking for alternative routes for a powerline or a waterline, for example, the map could show you where revegetation would be easier after construction."

"But, after determining possible alternative routes," Hunter added, "a more intensive on-site investigation would be needed."

There are many relatively undisturbed areas in the State where the authors could make detailed studies of the soil, climate, and vegetation. Information from the studies enabled them to predict what the natural vegetation would be on disturbed areas that had similar soils and climate.

In developing the climax vegetation map and report, Ross and Hunter had help from SCS employees in field locations throughout Montana, from Montana State University, the University of Montana, and other Federal and State agencies.

Meetings:

April	
4–6	Garden Club of America, Birmingham, Ala.
5–7	Engineering Geology and Soils Engineering Symposium, Boise, Idaho
9–11	American Pulpwood Association, Atlanta, Ga.
9–12	Association of American Geographers, New Orleans, La.
17–21	American Geophysical Union, Washington, D.C.
19–21	Air Pollution Control Association, Conference on Methodology for the Assessment of Air Pollution Effects on Vegetation, Minneapolis, Minn.
19–21	Hardwood Plywood Manufacturers Association, Panama City, Fla.
24–26	National Academy of Sciences, Washington, D.C.
29–May 4	American Society of Planning Officials, Indianapolis, Ind.
30–May 2	Chamber of Commerce of the United States, Washington, D.C.
May	
1–5	League of Women Voters, Cincinnati, Ohio
6–7	Sierra Club, San Francisco, Calif.
6–9	National Forest Products Association, Washington, D.C.
17–19	Boy Scouts of America, Phoenix, Ariz.
17–19	Southern Forestry Conference, Savannah, Ga.
June	
4–8	National Council of State Garden Clubs, Inc., Detroit, Mich.
4–9	General Federation of Women's Clubs, Phoenix, Ariz.
11–15	Outdoor Writers Association of America, Virginia Beach, Va.
19–27	Soil Science Congress, Edmonton, Alberta, Canada
24–29	National Environmental Health Association, Snowmass, Colo.
25–28	American Plywood Association, Portland, Oreg.
25–28	National Watershed Congress, Toronto, Ontario, Canada
25–29	American Seed Trade Association, Inc., Kansas City, Mo.
25–30	American Water Works Association, Atlantic City, N.J.
26–30	Air Pollution Control Association, Houston, Tex.
27–30	American Society of Agricultural Engineers, Logan, Utah

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